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ABSTRACT

This study identifies the opinions and ideas of black scientists that are agreed upon by black elementary school teachers as being useful for improving the science education experiences of black elementary school children. Background information about the scientists and teachers who participated in the study is provided. Relevant literature is reviewed. Findings presented indicate that activities associated with teacher influence, parental involvement, community influence, and role models may be useful in altering the attitudes of black children toward science. Teacher influence is said to be most important in affecting this change. Appended to the work are samples of the questionnaires used to collect information from scientists and teachers, as well as statistical tables of the findings. References are also attached. (EB)

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ABSTRACT

AN ANALYSIS OF OPINIONS FROM BLACK SCIENTISTS AND THE RESPONSES OF ELEMENTARY SCHOOL TEACHERS CONCERNING SCIENCE EDUCATION FOR INNER-CITY YOUTH

By

Roedean S. Anderson

B.S., Spelman College

M.A., Howard University, 1974

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A Dissertation Submitted in Partial Fulfillment of
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ABSTRACT

The major purpose of this study was to determine and catalogue specific information about science instruction for inner-city elementary school children that had been derived from the backgrounds, ideas and opinions of Black scientists. Secondly, this study was proposed to determine the extent of agreement inner-city teachers may have with the information from the scientists. The hypothesis guiding this research is stated as follows: Significant differences will exist between Black scientists and Black elementary school teachers concerning information that can serve as a basis for guidance in formulating new instructional approaches for science education in inner-city elementary schools.

In a questionnaire the scientists were asked to provide demographic information and to develop a statement on what they believed could be done to modify the attitudes of Black children towards science. Questionnaires were mailed to 125 Black scientists and 59 percent were completed and returned. Data from the questionnaire provided seventy nine statements that were used in an opinionnaire which was distributed to 141 teachers in Atlanta, Georgia and Washington, D.C. They were asked to

provide information on a few demographic items and to show agreement or disagreement with each statement from the scientists.

These statements had been classified into four major categories: Teacher Influence; Parental Involvement; Role Models; and Community Influences.

All data in this study was processed with the Social Science Statistical Package. Statements with Chi square levels of agreement ($P \leq .05$) between the scientists' variables and the teachers' responses were accepted as significant.

The scientists and teachers were found to be in agreement on activities associated with teacher influence; parental involvement; role models; and community influences for affecting change in the attitude of Black inner-city elementary school children toward science.

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CHAPTER I

INTRODUCTION

Background to the Study

There is in America today a disproportionate number of Blacks pursuing active careers in science (Nature, 1978). Jay (1969) found that about 580 American Blacks, living or deceased, had doctorates in a natural science. This low number was further substantiated by Craeger (1971). He indicated that fifteen percent of the doctorates awarded in the natural sciences went to foreign students, whereas less than one percent of those awarded went to American Blacks. Richardson (1974) in a later study found that no significant increase had occurred in the number of Blacks who had received doctorates in a natural science. Furthermore, he indicated that approximately 950 Blacks were recipients of doctoral degrees in this area dating from 1976, when the first was received by Bouchet in physics. The above data show that little change has been made over several decades in the quantity of American Blacks who hold doctorate degrees in a natural science.

In spite of the heavy emphasis on science and technology in today's society, less than one percent of the Black population enters the field of science (Gonzales and Augustine, 1976). During the history of Blacks in America, however, their obvious presence in athletics, entertainment and politics has been noted (Ferguson, 1975). Furthermore, a high degree of achievement has been obtained by Blacks in these areas. Concomitantly, the number of Blacks holding memberships in the National Academy of Science is dismally low, probably one or two, and furthermore no Black Americans have received the Nobel Prize in Science.

The estimate as of 1979 was that approximately 1100 to 1200 Blacks have been awarded doctorates in the natural sciences. An explanation for the uncertainty of this figure can be found in Jay's study (1969), pp. 4-5. He stated that essentially the difficulty is due to the manner in which the records are kept by degree granting institutions. From the resources available, the writer believes that the above estimate is reasonable.

Rationale

If the number of Black scientists is to be increased in the future, an effort has to be made to raise

the interest in science among Black children. The key to increasing the number of Blacks in science and the level of science consciousness within the Black population may be found in the kind of interest and attitudes toward science formed by Black children in their pre-adolescent years. Attitudes are important determiners of behavior, and they develop out of an individual's experience (Noll, 1965).

The interest and attitudes that the inner-city Black child has toward science will be influenced materially by the kind of science curriculum and program that he is exposed to in school. More important, it needs to be made evident to each Black child that he or she may have the potential and opportunity to become a participant in the science world as a producer, a creator or an informed citizen.

The school experience can be one of the greatest in the lives of children since the school provides an opportunity and setting for exposing young people to a variety of educational, social and cultural experiences. Effective educational programs in elementary schools often have the support and interaction of the community, parents, teachers and administrators.

According to Ferguson (1975) the scarcity of science activities and careers among Black Americans is

probably due to the nature of American society. This science education there continues to be a disproportionately low number of young Blacks who are in science careers or in science studies beyond high school. Moreover, little has occurred that would cause one to anticipate a change in the results of the studies of Jay, Craeger, or Richardson, if they were to be done in 1979.

There is a need for a new approach in designing and implementing elementary science curricula for inner-city children. Normally the source materials, planning and policy decisions regarding the education of Black inner-city children are provided by people who lack the kinds of experience or insights that are needed for designing and implementing effective programs for these youngsters. The American Black scientists and Black teachers from inner-city schools could be a valuable resource for ideas and opinions concerning science education for Black youth. There is no evidence to show that these groups have been used collectively in contributing to the formulation of science curricula for inner-city schools.

The Black scientists represent persons who have succeeded in the face of great odds in the American educational system. The Black teachers in the inner-city schools, on the other hand, are faced with the challenge

of helping young people to realize their fullest potential. In many instances the teachers are working in situations that were faced similarly by Black scientists in their youth. Clearly these two groups, the scientists and inner-city teachers, could provide important and useful contributions to the development of science curricula and policy decisions regarding science instruction in inner-city elementary schools.

Given the current situation regarding the low number of Blacks who are in science careers; the sociological and legal climate in America today, it would be useful to: (1) illicit from Black scientists demographic information; opinions and ideas regarding the essence of their nurturing and the encouragement received by them during their formative years; (2) collect from Black scientists information about the forces acting on them during their subsequent career development and what they believe can be done to encourage Black youth to study science.

Additionally, recognizing the role and the responsibility that Black inner-city teachers have in the education of Black youth, the level of agreement that exists between them and the scientists regarding science educational needs should be obtained.

It would be important to know whether any ideas proposed by Black scientists would be agreed upon by teachers, because in the final analysis the teachers will have to implement the curricula. Those ideas and opinions which the scientists and teachers agree upon can form a basis for the formulation and development of science curricula that will be specifically designed for inner-city children. Although one recognizes that a program so designed may overlap or perhaps have portions that are commonly found in other science curricula. However, the driving force and major thread of those opinions and ideas agreed upon will be based in the American Black experience of the Black scientists and the inner-city school teachers.

Finally, it must be understood that the primary concern in this study was not to determine whether Black children can learn science, but whether or not Black scientists and teachers believe and agree on what should be done about the mode and quality of science instruction and the kinds of exposure that Black children receive in this subject. A desireable outcome for these children would be for them to gain a greater interest and positive attitude toward science. This could perhaps create a greater tendency for them to include science as a potential

career or to function as better informed citizens in a science oriented world.

Statement of the Problem

From the information available, there is evidence of a scarcity of Black Americans who are actively engaged in the careers of a natural science. Presently, the education and training of these persons is primarily the responsibility of public schools. Within the inner-city, the public school population is primarily Black. These children at the elementary level do not appear to have the motivation, attitude or interest in science that would ensure greater numbers of Black Americans who in the future would be pursuing science careers or have the science educational background to appreciate the world in which they will live. Thus, the major problem of this study may be stated as: How can Black elementary children be motivated to have an interest and attitude toward science that will ensure that they will function ably as individuals in a science oriented society?

Purpose of the Study

The major purpose of this study was to determine and catalogue specific information about science

instruction for inner-city elementary school children that has been derived from the backgrounds, ideas and opinions of Black scientists. Secondly, this study proposes to determine the extent of agreement the inner-city teachers may have with the information from the scientists.

Specific objectives were:

1. To determine the general demographic characteristics of the Black scientists who participated in this study.

2. To identify the opinions and ideas of Black scientists that are agreed upon by Black elementary school teachers as being useful for improving the science educational experiences of Black elementary school children.

3. To determine the general background and experience of the teacher participants.

Hypothesis

Significant differences will exist between Black scientists and Black elementary school teachers concerning information that can serve as a basis for guidance in formulating new instructional approaches for science education in inner-city elementary schools.

Limitations of the Study

Authenticity of responses to questionnaires were limitations which were inherent in the questionnaire technique used in this study.

This study was also limited to the activities of science education of inner-city elementary school children. In addition, it is limited to the opinions of American Black scientists and Black elementary school teachers. Interpretations by the author of statements made on the scientists questionnaire were further limitations in this study.

Definition of Terms

For the purpose of this study, terms were defined as follows:

1. Role Model: an adult individual who is perceived by a child to have those attributed and characteristics which he would like to possess at maturity.

2. Parental Involvement: actions taken by parents in regards to children's home environment, guidance and training that may influence their attitude toward science.

3. Teacher Influence: actions taken by teachers in regards to children's school environment, guidance and training that may influence their attitude toward science.

4. Community Influences: organizations and institutions which are available to encourage scientific activities among children.

5. Black Scientists: Black Americans who are science researchers, professors, or administrators and who have a doctoral degree in a natural science.

CHAPTER II

REVIEW OF RELATED LITERATURE

Introduction

There is no evidence which shows that either Black scientists or teachers have been asked to comment as a group on the science education for inner-city or Black youth. There are, however, some topics or areas of concern which appear to be relevant to this topic. The literature in these areas will be reviewed with the objective of establishing a framework for this study and its research approaches.

The final selection of the areas for literature review was influenced by the writer's experiences derived from teaching in inner-city schools, conversations with Black scientists, conferences with teachers and counselors, and selected readings.

The topic areas which were selected and subsequently reviewed deal with: (1) research findings on how the teacher can influence the learning activities in a classroom setting (Teacher Influences); (2) studies on the role of parents and how they may influence the child's learning through participation in the education program

(Parental Involvement); (3) the concept of role models with an emphasis on imitation (Role Models); (4) reports on the ways by which the community can influence the aspirations and school performance of children in science (Community Involvement); and (5) studies on the attitude of elementary school teachers and children toward science.

Solomon, Bezdex, and Rosenberg (1964) have indicated that teacher behavior can be categorized into two general types: (1) the teacher's personal relationship with pupils, his attention to emotional and social aspects of student's classroom life; and (2) the teacher's emphasis on the content of the course and systematic attention to the learning tasks. In earlier studies attempts were made to identify similar behavior types, but with different terminologies. Medley and Metzel (1957) defined the first type as emotional climate, Bryan (1961) as kindliness, responsiveness vs. harshness, aloofness and McKeachie (1961) as friendliness. The literature reviewed in this study will be limited to those studies which deal primarily with the interpersonal relationship, the teacher's warmth, concern, and expectations for the child's performance. It is believed that these types of teacher behavior in the classroom may be very important

for improving the inner-city child's interest toward science.

It has been revealed in studies that the aspirational level and the learning of the child can definitely be influenced by the level of the teacher's expectations (Becker, 1952; Davidson and Lang, 1960). Reed (1959) affirmed that the science interest of students are related to two factors: the teacher's ability to motivate and the teacher's ability to create a relaxed and interpersonal relationship with the pupil. Moreover, Cogan (1957) suggested that warmth and friendliness are important behaviors which should be exhibited by the teacher. His study pointed out that there is a definite relationship between the teacher's warmth and the amount of work performance of the pupils. The more friendly and warm the teachers are the more self-initiated and required work their pupils will do.

Some consideration has been given to student achievement in relation to warmth and permissive teacher behavior. A study was done by Christensen (1960) to determine if there was any relationship between the vocabulary and arithmetic achievement of the pupils and the warmth and permissive behavior of the teacher. Although a low correlation was obtained, there was a significant

relationship between the warmth of teachers and the achievement made in arithmetic and vocabulary by the pupils tested. Cromback (1963) maintained that in studies on teacher's success, warmth consistently appears as one of the two most important qualities.

Using the Carkhuff Scale for rating Positive Regards and the results of standardized achievement tests, Aspy (1968) discovered a positive relationship between the cognitive gains of the pupils and the positive regards of their teacher. Wright (1970) found that those teachers who conducted experimental science lessons recieved best results when they frequently used "thanks" to pupils' responses. Although some studies have revealed no significant relationship in the behavior of teachers and the performance of students (Medley, Metzel, 1959; Jayne, 1945), a substantial amount of research does support the idea that teacher behavior does have an effect upon pupil behavior.

Parental Involvement

The future plans of youth are influenced more by parents than by either peers or school programs. Although the home and school are both educational institutions it is only recently that both have occupied separate and

distinct roles in learning. Before the 1960's, parents were considered responsible primarily for the socio-emotional development of their children and schools were considered responsible for the child's intellectual development (Shader, 1973). Interest in elementary school parent involvement programs has steadily increased in recent years as has the number of research studies undertaken in this field. One factor which has served to perpetuate this trend has been the acceptance of early childhood education theories. Lillie (1972) suggested that emotional and social support; informational exchange; parent-child interaction; and parent participation are the major components of parent involvement.

There are indications that children of parents who are involved with teachers and school programs have a more positive attitude towards school and school activities. Furthermore, academic achievement of students has been found to be related to teacher-parent contacts or communications. Some examples were found in the following studies.

Regal (1963) demonstrated success in approving the academic performance of underachieving children utilizing parents as tutors. Also, Heisler and Crowley (1969) found evidence of a positive relationship between reading

achievement of first graders and the amount of communication between teachers and parents. Schiff (1964), moreover, made a similar observation with fifth graders. Finlayson (1971) concluded in his research that positive direct feedback from the parent to the child is an indicator of successful achievement in children. Similarly, Karnes (1969) found that youngsters whose mothers participated in parent education sessions showed greater intellectual growth.

Scott (1973) studied a Home Start Family-Centered Enrichment Program for Black and White Children. He concluded that Black children whose parents were actively involved with teachers and school programs made greater academic progress than children whose parents were not actively involved in the school environment. Children whose parents were involved reaped greater cognitive benefits and demonstrated more positive attitudes toward school and school activities than those whose parents were not involved. Furthermore, he stated that enrichment programs should utilize maximum parental involvement if Black children are to make substantive gains in the educative process. Moreover, Lloyd (1965) reported that the impact of New York City's special reading services was influenced by direct parental involvement to the point

that no child would be admitted to a reading clinic without parent participation. He further stated that parental involvement was not just a public relation nicety, but the progress of most children was in direct proportion to the amount of parental commitment.

In addition to parental involvement in school activities and its effect on the children's academic performance, researchers have shown that the parents' attitudes and expectations may also influence a child's academic growth.

There appears to be a direct relationship between the attitude of parents and their child's achievement on test scores, discipline, absenteeism, and a level of academic confidence. Furthermore, an examination of the attitudes of parents who participate in school programs reveals that they show decreased feelings of alienation from society (Stern, 1968); modify their life styles (Miller, 1969); improve the quality of interaction between themselves and their children (Boger, 1969); become more involved in the community (Karnes et al., 1970) and tend to like them better than their counterparts who do not participate (Six and Vugrim, 1971).

Reports from studies show that the levels of optimism and aspirations of parents have an effect on

the educational performance of children. Jacobs (1969) suggested that both optimism and the level of aspiration of Black and Latin American parents of Head Start children would increase as a function of their involvement in the Head Start program. Greene and Zirkel (1971) found that among Puerto Rican parents there was a great discrepancy between what they "hoped" their children would achieve and what they believed their children could attain academically. Expectations were high among these parents.

Buck and Austin (1971) studied fifty matched pairs of eight grade Afro-Americans selected from poverty schools in a large city. They found that mothers, regardless of their background or the educational achievement of their children, or social status, set high values upon education and hard work in order to reach academic goals.

It is clear from the literature that many studies have been done on the manner and mode of the influence of parents on their children's intellectual growth and development. It has been found that whenever parental involvement has been encouraged in school programs, the quality and quantity of the child's academic experiences are enhanced.

Role Models

The concept or term role model began to emerge in the fields of sociology and psychology about thirty-five years ago. The term encompasses a range of social and psychological interactions. Research findings on significant others (Sewell and Haller, 1969) and imitating (Flanders, 1968) are all pertinent for the development of a working concept for role model. There is a void in the literature on research as to the dynamics invovled in youth choices, rejections or adherences to early role models, once they become adults and live as part of the real world.

Some of the best information on role modeling as they may apply to this study can be found in atuobiographic literature of famous and successful people. Attention will be given here to some of the recent literature available from research on imitating and some of the factors and conditions that may influence imitative behavior. Some background on this aspect of the role model concept was deemed appropriate for this study.

Imitation has been defined by Flanders (1968) as the situation in which "observation of the behavior

of a model...affects the observer so that the observer's subsequent behavior becomes more similar to the observed...behavior of the model" (p. 316).

Following the attention given to imitation during the early part of the 20th century, Miller and Dollard (1941) developed a concept that was integrated into the framework of behavior-theory. The necessary condition for learning to imitate included a motivated subject who is positively reinforced for matching the appropriate responses of a model during a series of trial and error responses (Bandura and Walters, 1963).

Subsequently, in several studies, it was found that children imitate adults in societies where they live (Ford and Beach, 1951; Sears, Maccoby and Levin, 1957; Nash, 1963). Parents and adults have been found to have a strong influence on young children (Bandura and Kuppers, 1964; Harris, Wolf, and Baer, 1964).

Further research revealed that exposure to models exhibiting altruistic behavior resulted in similar behavior by 4th and 5th graders when models were no longer present (Rosenthol and White, 1967). An interesting finding was that the more complex the task, the more pressing the need for a concrete model, as in many

areas it is virtually impossible to teach a role without actual models (Kemper, 1968).

Media such as television and film were found to influence children and adolescents (Schramm, Lyle, Parke, 1951; Maccoby and Wilson, 1957). Additionally, Schramm, Lyle and Parke (1951) reported that television produces imitative behavior among children. Subjects that observed a filmed model performed a given task better than control groups or those who read about the idea (Belcher, 1975). Furthermore, prosocial behavior towards members of a different race can be learned from television (Zimmerman and Brady, 1975).

Under the various experimental conditions, children have been found to engage in imitative behavior. They will imitate live models, filmed and T.V. models. It would appear that under each condition that adult models have a profound effect on the child's imitative behavior.

Community Influences

> At present, policymakers assume that the school environment is of primary importance in the socialization of minority children. Thus, educational policies predominantly center on the school context. Concerns ranging from classroom organizations and

> teacher skills to matters of racial, ethnic, and social class integration are focused on the school context. What is potentially detrimental about the undue emphasis on the school context is that the importance of community and subcultural influences on minority education tend to be overlooked by educational policymakers....In their search for manipulable variables, policymakers tend to give more emphasis to various characteristics of the school context, the setting over which they have most formal and informal control. Yet, the major factors affecting minority educational attainment may not reside in the school context at all. Instead, community and subcultural influences may constitute the most important aspects of the total educational environment....Educational researchers and policymakers should think in terms of what policies can be designed and implemented which will enhance educationally enhancing values within community and subcultural contexts....Educational policy will have a much broader meaning than it now has in most policymaking arenas (Schumaker and Getter, 1977; p. 18).

Many cities and large metropolitan areas have in them institutions such as libraries, churches, colleges, universities and museums. In most instances, these institutions are all accessible to inner-city residents. Furthermore, these institutions may have permanent branches or occasional extention programs at locations within inner-city.

Aside from places of worship, churches have become full-time centers which provide programs for youth, young adults and the elderly. Libraries are no

longer considered primarily as depositories for books but have become major centers in the community for educational and recreational activities. They have made extensive use of films, exhibits and forums to provide information about cultures and technologies.

Along with libraries and churches, museums are also undergoing changes. According to Loomis (1974),

> Museums are changing from their traditional roles of scholarship and preservation of artifacts and adopting more community and social mission oriented programs. This shift increases the possibility for learning and evaluation in non-traditional environments (p. 10).

Some studies on the role of museums in learning will be examined in this paper. They are important in this study because they are commonly found in cities and often have science exhibits and programs especially for children.

Of all the institutions found in cities, museums have demonstrated clearly through special programs and research that they can effect concern, interest and enthusiasm for science among its visitors. They have been particularly effective with elementary school children in the areas of science. Kenard (1970) stated that "Museums can provide the creative enthusiasm that is needed by involving people on every level in the

practical application of science to the urgent problems of the inner city" (p. 21).

American museums work closely with schools and colleges. Many offer educational programs. A large museum in a big city may have several classes of students on guided tours each hour. Organized museum attendance may well exceed 500,000 a year. Museums provide for exploration outside the confines of the school curricula. City schools now use museums to supplement their curriculums and to help solve the problems of interesting disadvantaged children in learning. Through interaction with the exhibits a visitor can learn science through exploration and discovery. This procedure is better suited to scientific subject matter than the printed oriented classroom experience (Robbin, 1969).

Oppenheimer (1970) stated that:

> No one ever flunks in a museum. One museum is not a prerequisite for the next. Museums are free of many of the tensions which can make education unbearable and ineffective in the schools (p. 8).

Beardsley (1975) in his discussion of museums stated, "Learning science principles in a museum environment can actually be enjoyable, especially at museums of science and technology" (p. 192).

Furthermore, he believed that a methods course for teachers should give some attention to teaching science at a museum of science and technology.

Among the early studies on the use of museums in teaching are the experiments of Goldberg (1933). She observed that silent reading and picture cards given to children in the upper elementary grades prior to museum visits enhanced their understanding of science exhibits. Children between the ages of seven and twelve who visited specially designed series of manipulative museum exhibits gave higher numbers of correct responses on post-test than on pre-tests regarding particular sets of instructional information e.g. a total of 83 children were exposed to exhibits on teeth or the Main Series. Prior to the exposure to these exhibits, 57.2% of the answers were correct on the pre-test. The post-test indicated a significant gain in correct answers, 78.6% (Nicol, 1969).

Eason and Linn (1976) found that school children in the upper elementary grades who had been involved with participatory exhibits (optics) showed greater recall and ability to solve problems using manipulative skills than the control. They suggested that these exhibits provide the participants information in a non-traditional unstructured learning situation.

Borun (1977) in a study on museum effectiveness found that groups of school children were the predominant visitors to the Franklin Institute Science Museum and Planetarium in Philadelphia on weekdays from September through June. Grades K-9 represented 82% of this population. Among the teachers, it was found th t 25% of them brought the children to the museum to teach the class about science and 15% indicated that the visit was used to supplement a classroom science unit. The teachers (65%) indicated further that they felt these visits provided an above average to excellent positive learning experience for the children. Also 83% of the children enjoyed their visit. Borun states in her summary on museum effectiveness that data from pre-visit and post-visit test scores indicated museum visits were most effective in teaching basic science concepts.

Additionally, museum effectiveness has also been measured in other areas such as art with inner-city children. A total of 184 inner-city fourth grade children participated in a study at the High Museum of Art in Atlanta designed to determine whether they could learn to recognize the common elements to underlie all the arts. The pre-test and post-test results for 154 participants showed clearly that the experimentals scored significantly higher than the controls (Humm, 1976).

Screven has been concerned with improving or increasing instructional effectiveness of museum exhibits through the use of programmed audio cassettes, and question and answer devices which have been found to improve visitor learning (Screven, 1969, 1973, 1974).

Teacher and Children Attitudes

Conceptually, an attitude is a readiness to respond either positively or negatively (Johnson, 1974). The first attempts to measure attitudes were made by Watson (1925) and Bogardus (1925). Thurstone (1928) suggested propositions which reflect social attitudes could be scaled. Later Thurstone and Chave (1929) developed and published an explanation outlining the equal-appearing intervals methods of measuring attitudes. The basic tenets of their methods with some modification have persisted.

Measurements of science attitudes among teachers and children have received attention in recent years. A review of pertinent literature regarding teachers and children's attitudes towards science will be presented. Particular attention will be given to studies done with elementary school teachers and children.

Teachers with favorable attitudes toward science were found to cause a greater positive change in the achievement of students (Bixler, 1959). A lack of confidence for the teaching of science among elementary teachers was found to be due to feelings of inadequacy and fears of natural phenomena (Pitlz, 1962), inadequate science background and the belief among women teachers that science is a male domain (Victor, 1961). Soy (1967) in a study of the attitudes of prospective elementary teachers toward science provided some possible reasons for the poor attitudes among teachers. She pointed out that prospective elementary teachers usually pursue in college courses which they believe they have strength. These are usually language, arts and social studies. During their college stay they increase their strengths and abilities in these instead of other fields such as science. Moreover, she stated that a student teacher who chooses a subject field in science has more background in science and math and will have, perhaps, a farm background. In another study by Barretto (1969) of three hundred prospective elementary teachers a corollary was found between semester hours or grade point average and attitudes towards science. Students with high grade point averages and more semester hours in science were

found to have positive attitudes towards science. Shrigley (1974) found that pre-service teachers who had taken high school science courses showed a more positive attitude towards science education courses and tend to achieve more in these courses.

Programs designed to change the attitudes of pre-service elementary teachers towards science and math have been successful. Oshima (1966) found that pre-service elementary science teachers who were taught a college science course using the individual investigation method showed a slight positive change in attitude toward science when compared with those taught by the lecture demonstration method. No significant difference in attitude or mind set was found in a study by Diehl (1967) in which one group of pre-service teachers was taught physical science using a standard lecture laboratory approach and the other which has a non-directive teaching and pervasive laboratory experience. Litwiller (1968) observed that the attitude toward math of prospective elementary teachers could be changed through the study of enrichment problems. In her study, an experimental group was given an enrichment problem and the control group was not. Tests showed that the attitude of the experimental group toward mathematics was more positive than those of the control group.

The attitude of inservice elementary school teachers toward science has been examined. Groff (1963) and Green (1967) stated that the teacher's attitude is the most critical variable in the educative process.

Wytiaz (1962) made a survey of the attitudes of seventy fifth grade teachers toward science. An analysis based upon 64.3 percent returns showed that 51.1 percent felt that their background was insufficient to teach science. They had, however, a favorable attitude toward taking science courses. Most of the teachers indicated that science was important to the children. Moreover, they felt that college should provide pre-service teachers with a good and practical background in science. Leake (1966) failed, however, to find any significant effects of science extension courses on the attitude of elementary teachers toward science.

The effects of teachers' attitudes toward science and mathematics on the students' attitudes toward these subjects have been examined. Keane's (1968) findings were inconclusive regarding teachers' attitudes toward mathematics and its effect on elementary students' attitudes toward arithmetic. Negative correlations were found between teachers' attitudes and toward teaching mathematics and students' attitudes toward mathematics (Gilbert, 1976).

Attempts have been made to modify children's attitudes toward science through changes in the mode of instruction. Below are some examples and results.

Children's attitudes toward elementary school science were studied in three school systems in the state of Georgia. The schools selected were in large metropolitan school districts, a city of 50,000 population and a rural county having one consolidated school (Perrodin, 1966). He found that among the 554 pupils studied that fourth graders had very favorable attitudes toward science, favorable attitudes peaked in the sixth grade followed by a decline in the eighth grade. The children considered science to be an important subject and many fourth and sixth graders considered it more important than play.

In a similar study Ayers and Price (1975) reported on the attitudes toward science of 455 children from the Southern Appalachian region. They found that there were no major differences between males and females. Moreover, fourth grade students had more positive attitudes toward science than fifth graders and that sixth graders were the most negative in their attitude towards science. Children at each grade level felt that science was important.

Lowery (1967) demonstrated further that the attitudes of elementary children toward science could be detected and with effort a measurable change can be noted over a seven to eight week period of time.

Six hundred and fifty seventh grade students who were exposed to the intermediate science curriculum study showed a significantly greater positive attitude toward certain aspects of science when compared to the control group of two hundred students (Lauridsen, 1972).

The attitudes of sixth graders toward science who had a Process Approach Program were compared with those who had been taught with the conventional textbooks. A more positive attitude was found among those who had the Process Approach Program (Simmon and William, 1972).

O'Brien (1973) and Brown (1975) showed that the science curriculum improvement study program does develop positive attitudes toward science in elementary school children.

No significant difference was found in the attitudes towards science of seventh grade students who had laboratory experiences using traditional science or ordinary household materials and equipment (Moyer, 1977).

Johnson (1973) found that the attitudes of disadvantaged children toward mathematics in grades two

through six became more positive after participating in an Individually Prescribed Instruction Mathematics Project. Television instruction was found to improve the problem solving attitudes of fifth and sixth graders.

In summary, the literature reviewed in this chapter presents a background of studies on areas which are believed to be useful in the development of a program for promoting an interest in science among inner-city children. Research in the areas of Teacher Influences; Parental Involvement; Role Models with particular emphasis on imitating; and Community Involvement, museums in particular, have revealed clearly that they can become agents capable of producing quantifiable changes in the behavior of children.

Furthermore, there is interrelationship between the attitude of students and the attitude of teachers in regards to science. The attitude of teachers toward science can influence the attitude of their students toward this subject. In both cases these attitudes can be modified.

CHAPTER III

METHODOLOGY

A survey was made among Black scientists in order to obtain from them (1) demographic information, (2) statements regarding their motivation and interest toward science, and (3) ideas as to what could be done to stimulate a greater interest among Black youth toward science.

Ideas or opinions expressed by the scientists were used as the basis for an opinionnaire which was distributed to elementary school teachers. The teachers were asked to indicate their agreement or disagreement with each idea or opinion.

Questionnaire Recipients

Lists of Black scientists were obtained from the roster of the National Institute of Science, an organization of Black science professionals and science faculty members from Howard University. This list represented more than 95% of the approximate 500 Black scientists in America, according to the above source.

One hundred twenty-five Black scientists, who hold doctoral degrees in a natural science, were selected randomly from eduational institutions, industry, and governmental services. This sample represents the major areas in the natural sciences, life sciences and mathematics. They were mailed questionnaires with a cover letter of explanation (Appendix B). Since there is a limited number of Black scientists with doctorates in America, selection and contacts were made throughout the country irrespective of state or region.

Questionnaires were distributed in the Fall of 1977. Nearly thirty-five percent were returned. Approximately six weeks after they were mailed, follow-up requests were made by postcards and individual telephone calls. With these follow-up requests a total of seventy-four questionnaires were received which constituted approximately 50 percent of the total initially mailed.

Opinionnaire Recipients

One hundred forty-one opinionnaires were distributed to inner-city elementary schools in Washington, D.C. and Atlanta, Georgia. Verbally, the principals of these schools agreed to distribute the opinionnaires to volunteer teachers within their buildings. One hundred

persons representing ninety-four elementary school teachers participated. Four counselors and two administrators voluntarily agreed to participate in this project.

The criteria for selecting these teachers were: (1) they were currently employed in inner-city schools; (2) they were readily assessible to the writer in the cities indicated.

Data Collection

Questionnaire

A questionnaire was developed by the writer and field tested by ten persons pursuing active careers in science. These persons were accessible and agreed to complete this task. They represented the natural sciences. It was believed that the opinions of ten science persons would give the questionnaire validity and creditability. After suggested revisions were made it was again reviewed by science professors at Howard University. This group of ten was selected because they stated an interest in the science education among Black children.

There was a common agreement among the latter group that this instrument would be useful for ascertaining the kind of information and data sought by the

writer. Subsequent revisions were again made and the final questionnaire prepared.

This questionnaire consisted of two parts. Part 1 was designed to collect data on the demographic background of scientists. Part 2 consisted of open-ended questions which were to be answered within the guidelines provided. The objective of Part 2 was to find out what the scientists had to say about their own motivation and interest toward science and to obtain ideas from them as to what could be done to stimulate among Black youth a greater interest toward science.

Opinionnaire

Upon analysis of the opinions and statements of the Black scientists presented in Part 2 of the questionnaire, a list of seventy-nine statements was prepared. They were grouped into four categories: Role Models, Community Involvement, Parental Involvement and Teacher Influences. Several statements or opinions could not be included in any of the categories and are considered descriptive of those characteristics believed to be common to the personality of a scientist.

A seventy-nine item questionnaire was distributed to public school teachers and a limited number of

counselors and administrators. The recipients were instructed to indicate agreement with the items by placing the letter "A" to the left of the statement or the letter "D" in case of disagreement. No provision was made for the category of indecision.

Analysis

The Statistical Package for the Social Sciences (Nie et al., 1975) was used for the statistical analysis. These data were subjected to descriptive and inferential treatment.

Frequencies and cross-tabulations for the variables were presented. The chi-square test for independence was used to determine whether there was significant agreement between the scientists and teachers about the specific needs for an effective elementary inner-city school science program. Those statements that received a chi-square value $\leq$ .05 level were considered to be significant.

These data were run at the Howard University Computer Center on an International Business Machine - 370/158.

CHAPTER IV

RESULTS

A description of the findings is presented in this chapter. Narratives and tables were used to describe the data related to the demographic characteristics of the scientists and teachers and all appropriate information from the data generated from the computer analysis.

Age and sex of the Black scientists are displayed in Table 1. Of the seventy-four participants, over three-fourths were men. Sixty-one males and thirteen females completed the questionnaire. The ages of the male scientists ranged from thirty to over sixty-nine years. Nearly one-third of the men was in the youngest group which was between the ages of thirty and thirty-nine. A large portion of the male scientists (64%) was between the ages of thirty and forty-nine. Twenty-two men were fifty years old and older. The majority of the feamle scientists were in the upper age range. Two were in the age range of twenty to thirty-nine; seven were in the age range of forty to fifty-nine; and two were in the age range of sixty to sixty-nine years.

The marital status of the Black scientists is displayed in Table 2. Among the Black scientists, nine

TABLE 1

Distribution of Ages and Sex

of Black Scientists

Age Range	Male		Female		Total No.
	No.	Percent	No.	Percent	
20-29	0	0.0	1	7.7	1
30-39	21	34.4	1	7.7	22
40-49	18	29.5	3	23.0	21
50-59	16	26.2	4	31.0	20
60-69	4	6.6	2	15.3	6
Over	2	3.3	0	.0	2
No Response	0	0.0	2	15.3	2
Total	61	100.0	13	100.0	74

were single and had not been married. Two-thirds of the men and women were married and currently living with the spouse. Nine of the men and none of the women had experienced broken marriages, as indicated by divorce, separation or death.

TABLE 2

Marital Characteristics of

Black Scientists

Marital Status	Male Number	Female Number	Total Number
Single	7	2	9
Married	48	7	55
Divorced	5	0	5
Separated	1	0	5
Widowed	1	0	1
No Response	2	3	5
Total	61	13	74

The early childhood residences of the Black scientists are reported in Table 3. A small percentage of the scientists spent their early childhood in a metropolitan area whereas the majority (62.2%) of them lived in either a city or town and thirty-four percent indicated that they had spent their early childhood in a rural area. Geographically, 60.8% reported that they spent their childhood in the South and the remainder were distributed in the North (13.5%); the East (18.9%); and the West (6.8%).

TABLE 3

Early Childhood Residences of

Black Scientists

Location	Number	Percent	Geographical Region	Number	Percent
Rural	25	35.8	North	10	13.5
City	32	43.2	South	45	60.8
Town	14	19.0	East	14	18.9
Metropolitan	3	4.0	West	5	6.8
Total	74	100.0	Total	74	100.0

Perusal of Table 4 provides some insight as to the sizes of the families of the scientists. Twelve scientists indicated that there were seven siblings in their families. One reported that there were twelve siblings in his family. Furthermore, the majority of the scientists reported that they were either the first or second child in their family.

The pre-college educational background of the scientists as displayed in Table 5 reveals that the majority of the scientists attended an elementary school located in the South. Of those who responded to the

TABLE 4

Number of Siblings in Scientists' Family and Scientists' Position in Family

Number of Scientists	Number of Siblings	Number of Scientists	Family Position
1	9	1	8
1	12	1	9
2	10	2	5
2	11	2	7
3	7	3	6
3	8	4	3
4	1	9	4
4	3	19	2
4	5	24	1
7	6	2	-
9	0	-	-
10	-	-	-
15	2	-	-

questions on school enrollment, nineteen attended an elementary school that had an enrollment of 500 or more; thirteen attended schools that had enrollments of less

TABLE 5

Some Aspects of the Pre-College

Educational Background of the Black Scientists

Educational Level	Location		New England	South	Mid West	West Coast	School Enrollment Range	Program Emphasis		
	Rural	City						Academic	General	Vocational
Elementary School	63	7	11	40	9	2	0- 99 - 4 100-199 - 1 200-299 - 2 300-399 - 3 400-499 - 5 500-over-19			
High School	65	5	11	46	11	2	0- 99 - 1 100-199 - 4 200-299 - 3 300-399 - 2 400-499 - 0 500-over-31	48	12	3

than 500. Thirty-eight attended high schools that had enrollments of over 500 students. The program emphasis of the high schools attended by the scientists were academic (48); general (12); and vocational (3).

Some aspects of the post secondary educational background of the Black scientists are displayed in Table 6. Nearly two-thirds of the scientists attended a predominantly Black college in the southern region of the United States. Two-thirds of them received their baccalaureate degrees between the years of 1940 and 1969. Most of the scientists received their terminal degrees from a predominantly white university. More than half of the universities attended by the scientists were located in New England and in the Mid-West. More than one-half of the doctorate degrees were received during the period of 1950 to 1969.

Most of the participants had access to a library during their pre-college years. As indicated in Table 7, seventy percent of the Black scientists had the opportunity to go to a public library and over half (55.4%) of the participants had libraries in their homes. Thirty-six percent had access to both public and home libraries.

TABLE 6

Some Aspects of the Post Secondary

Educational Background of the Black Scientists

Educational Level	Racial Characteristics of School		Regional Location				Dates Degree Received				
	Black	White	New England	South	Mid West	West Coast	1930-39	1940-49	1950-59	1960-69	1970-79
Under-Graduate School	47	22	13	44	12	2	7	12	17	19	5
Graduate School	3	64	21	16	24	9	4	6	14	32	10 *

* Note: All graduate degrees were the Ph.D., except for one DSc.

TABLE 7

Access to Libraries Among

the Black Scientists

	Home		Public		Both	
Responses	No.	(%)	No.	(%)	No.	(%)
Yes	41	55.4	52	70.3	27	36.5
No	33	44.6	22	29.7	47	63.5
Total	74	100.0	74	100.0	74	100.0

In Table 8, it is revealed that twenty-nine of the participants' fathers were laborers and twenty-four of their mothers were housewives. Nearly one-third of the scientists' parents, father or mother was employed professionally. Nine fathers were either domestics, farmers, or self-employed, and sixteen mothers were either laborers, domestics, or self-employed.

As indicated in Table 9, fifty-five of the scientists were employed in educational institutions and had one or a combination of one of the following duties: teacher, researcher, or administrator. The remainder, nineteen were employed in either the government or industry.

TABLE 8

Occupational Categories of
the Scientists' Parents

Occupational Categories	Father's Occupation	Mother Occupation
Professional	18	15
Laborer	29	8
Domestic	1	6
Farmer	4	2
Self-employed	4	2
Full-time Housewife	-	24
No Response	28	29

The major fields of concentration for the doctorate degrees are displayed in Table 10. The life sciences were the major doctorate fields of concentration for twenty-one males and four females. Thirty-two males and five females indicated a field in the physical sciences and there were three males and one female in mathematics.

TABLE 9

Type of Employment and Major Duties of Scientists

Type of Employment	Major Duties		
	Teaching	Research	Administration
	Number	Number	Number
Education	30	7	18
Government	0	4	7
Industry	0	2	6
Total	30	13	10

In Table 11 the number of publications generated by the scientists is indicated. Sixty-eight of them have published a total of more than 1300 journal articles; six published a total of twelve books; nine published a total of twenty-eight monographs; and seventeen indicated a total of eighteen publications other than those mentioned above.

TABLE 10

List of Major Fields of
Ph.D. Concentration for
Black Scientists

Major Concentration	Number	
	Male	Female
Bacteriology	6	0
Biology	5	2
Botany	4	1
Chemistry	15	3
Engineering	1	0
Environmental Health	1	0
Genetics	1	0
Geology	1	0
Health Sciences	1	0
Mathematics	3	1
Physics	16	2
Total	57	50

TABLE 11

Number of Publications of

Black Scientists

Type of Publications	Number of Scientists Who Published	Total Number of Publications
Journal Articles	68	1303
Books	6	12
Monographs	9	28
Other	18	18
Total	101	1361

Nineteen percent of the Black scientists, as revealed in Table 12, had taught science at some time in their careers to Black youth at the pre-college level. The remaining scientists (81%) did not have this experience.

The age and sex of the participating teachers are indicated in Table 13. Among the seventy-two teachers who indicated their sex, forty-five were female and twenty-six were male. Approximately three-fourths of the teachers ranged in age from thirty to forty-nine.

TABLE 12

Response of Black Scientists to the Question: Have You Taught Science to Black Youth?

Responses	Number	Percent
Yes	14	19.0
No	60	81.0
Total	74	100.0

There were twelve between the ages of twenty and twenty-nine years, and seven indicated an age between fifty and sixty-nine years.

The teachers' experiences when examined for duties and grades taught revealed that fifty-seven of them taught grade four through six; twenty-three indicated that they taught grades kindergarten through grade three; and sixteen had taught all grades. Furthermore, sixty-nine of the teachers had five to nineteen years of teaching experience; two had one to four years; eight had twenty to twenty-four years; and six indicated over twenty-five years of experience.

TABLE 13

Age Range and Sex of Elementary School Teachers

Age Range	Total Number of Responses	Male Responses	Female Responses	No Responses
20-29	12	2	5	5
30-39	48	17	20	11
40-49	26	3	12	11
50-59	6	2	3	1
60-69	1	0	1	0

A perusal of Table 15 revealed that half of the elementary personnel in this sample majored in elementary education and the remainder was distributed among fourteen major fields.

An analysis of the comments made by scientists produced thirty-one (31) statements or opinions related to teacher influences; twenty-one (21) that were related to parental involvement; thirteen (13) related to role models and thirteen (13) related to community.

TABLE 14

Grade Level Taught and Number of Years Teaching for Elementary School Teachers

Grades Taught	Number of Teachers	Range of Teaching Years	Number
K-3	23	1-9	27
4-6	57	10-19	54
A-11	15	10 and over	14
No Responses	5	No Responses	5
Total	100		100

TABLE 15

College Majors of Elementary School Teachers

College Majors	Number
Administration	1
Art Education	1
Biology	4
Business	2
Elementary Education	50
Guidance	3
History	3
Home Economics	4
Language Arts	3
Math	2
Music	2
Psychology	3
Special Education	2
Sociology	4
Zoology	2

The teachers agreed significantly with thirty (30) of the statements relating to teacher influences; seventeen (17) relating to parental involvement; eleven (11) relating to community and ten (10) relating to role models.

In Tables 16, 17, 18 and 19 are displayed the statements from the scientists with which there was significant agreement ($p \leq .05$) in cross-tabulation with the agreement or disagreement responses of the teachers and variables of the scientists. All statements which had significant Chi Square values ($p \leq .05$) in cross-tabulation with five or more variables were considered important and are grouped under the categories of Teacher Influences; Parental Involvement; Community Influences; and Role Models.

Further rankings of the statements were made within each group according to the general overall values of significance ($p \leq .05$) for the variables found in association with a particular statement. Statements with generally low values of significance were considered to be of greatest importance in the particular category followed by lower orders in rank for those which had successively higher values (Appendix B).

Table 16 contains a listing of the statements related to the category of teacher influence which had significant agreement ($p \leq .05$) among the teachers and variables of the scientists. There were two (2) statements, each of which agreed with 10 variables; one item which agreed with seven (7) variables; two (2) items which agreed with six (6) variables; and three (3) items, each of which agreed with five (5) variables.

TABLE 16

A Listing of Statements in Descending Order of Importance Regarding Teacher Influences About Which There Was Significant Agreement ($p \leq .05$) Between Elementary School Teachers and Black Scientists

STATEMENTS
1. Science specialists should travel from school to demonstrating science units to students in elementary schools.
2. Elementary school students who are able to interact with science and not just learn it are more apt to have positive attitudes toward the subject.
3. It is essential that young children be introduced to scientific methods through examples from their lives and convinced that appropriate analytical skills are obtainable and necessary for the study of science.

TABLE 16, continued

4. The teacher should coordinate his or her efforts with the parents and the community to select and dramatize Black scientists.

5. Elementary school students with natural abilities in science should be identified and encouraged early.

6. To foster a positive outlook toward Black scientists, teachers could explain the contributions made by them to elementary school students.

7. Elementary school children should discover (through current events as well as basic information) that their whole life is surrounded by science, its devices and problems.

8. Teachers are perhaps the most important people that young people meet in influencing what becomes their favorite subject and often career field.

9. Use living specimen in experiments.

10. Teachers should make elementary school students aware of the rewards (personal and financial) for mastering science.

11. Effective teachers should include facts of Biology to students in the elementary grades with the primary principles of ecology emphasized.

12. A positive attitude toward science could be generated among elementary school students through tutorial demonstrations and visits to scientific job areas.

13. Perhaps elementary school teachers could initiate a link between racial pride and a personal challenge in order to create a positive attitude toward science.

14. The technique that has a higher than normal impact as a motivational tool for positive attitudinal changes for elementary school students is the "problem centered approach" in teaching science.

15. The teaching of science must be made interesting by relating science of students' environment.

TABLE 16, continued

16. Personal exposure of elementary school students to scientific equipment, ideas and professionals is essential in the task of implanting the desire for a scientific career.

17. Elementary school children should see science as interesting and not as being difficult or weird.

18. The role of the teacher is to spark independent inquiry and to start the student asking his own questions and generating his own answers.

19. Math and science are related; therefore, good instructions in math is helpful in fostering a positive attitude toward science.

20. The most significant influence can be attributed to the interest, concern and comfortability evidence by teachers who teach science.

21. To encourage students in elementary school to develop a positive attitude toward science, teachers should expose them to the interesting and intriging aspects of science.

22. Although teachers can provide some exposure to science, motivation has to come from within the student.

23. The attitude of teachers toward science is important.

24. Attitudes may not be dictatorially established.

25. Positive attitudes toward science are bound to occur when teachers are held accountable for students receiving maximum science exposure in the elementary grades.

26. A negative attitude toward science may develop when students are exposed to science teachers whose primary training of interest is not science.

27. The ability to communicate verbally and in written form is of paramount importance in science for students in elementary school.

Table 17 contains a listing of the statements related to the category of community influence. Of the statements concerned with community influences which had significant agreement ($p \leq .05$) among the teachers and variables of the scientists were five (5) items found to be in agreement with five (5) variables; and one (1) item was found to agree with six (6) variables. All other items fell below the arbitrary cut-off of agreement with five (5) variables.

Tables 18 and 19 contain listings of the statements related to the categories of parent involvement and role models, respectively. One statement was found in each of these categories which had significant agreement ($p \leq .05$) among the teachers and scientists. The statement in the category of parent involvement was found to be in agreement with six (6) variables and the statement in the category of role models was in agreement with eight (8) variables.

TABLE 17

A Listing of Statements in Descending Order of Importance Regarding Community Influences About Which There Was Significant Agreement ($p \leq .05$) Between Elementary School Teachers and Black Scientists

STATEMENTS
1. The community should encourage its scientific organizations and institutions to hold open house activities for the elementary schools.
2. There should be an organized effort by the community to provide role models for the children.
3. Science and math clubs should be sponsored by community agencies.
4. Childhood exposure to nature will lead to an interest in science.
5. The community should provide opportunities for students to see what is going on in the scientific world.
6. Visitations by children to science exhibits that they can handle may be helpful.
7. The local communities should provide for Black films, demonstrations, science fairs and visits to science museums for elementary school students.
8. The institutions of higher education should sponsor science programs for Black elementary school children.
9. The community can provide some degree of exposure to science, although the motivation for study of science has to come from within.

TABLE 17, continued

10. Scouting programs are helpful in creating positive attitudes toward science.

11. General community programs should be designed to bring parents and local industry into dialogue to assist in stimulating students' interest in science.

12. Educated parents are more likely to influence children to participate in science activities.

13. Museums should sponsor science fairs involving the use of Black role models and exhibits of projects jointly developed with these Black scientists.

TABLE 18

A Listing of Statements in Descending Order of Importance Regarding Parental Involvement About Which There Was Significant Agreement ($p \leq .05$) Between Elementary School Teachers and Black Scientists

STATEMENTS
1. Parents can provide many experiences around the home for elementary school students that would generate the development of a strong background for technology and a positive attitude for the sciences.
2. A child whose parents are scientists are more likely to have a positive attitude toward science.
3. Only one parent is necessary to encourage a positive attitude toward science.

TABLE 18, continued

4. Students with a special aptitude for science should be encouraged by parents to pursue this vocation.

5. Parents who support the student in his pursuit of science are those who do not placate the child with, "I don't understand it either."

6. Parents should work with the teachers in developing good orderly study habits and an appreciation for science and technology as it is applied to everyday living.

7. A father's occupation may influence a child to have a positive attitude toward science.

8. Early orientation to science can be related to one's ethnic heritage.

9. Poor and undereducated parents can be influential in the education of their children in science.

10. Parents who encourage their children to play with scientific toys are also encouraging positive science attitudes among them.

11. A disciplined home environment will contribute to the success of students in science.

12. Parents should assist children in their science work until the child becomes more aggressive in their attitude toward science.

13. Science and science-related TV programs could serve as a stimulus to elementary school students if TV viewing is monitored by parents.

14. Parents should encourage their children's curiosity about the physical and/or biological world.

15. Families can motivate elementary school children to develop meaningful objectives with education as a decisive tool.

TABLE 18, continued

16. Mothers sometime think science is not a proper subject area for women.

17. A child's interest in science and education is created and initiated in the home.

18. Parental involvement will have a small effect on the science attitudes of elementary school children.

TABLE 19

A Listing of Statements In Descending Order of Importance Regarding Role Models About Which There Was Significant Agreement ($p \leq .05$) Between Elementary School Teachers and Black Scientists

STATEMENTS
1. Elementary school children should be exposed to both Black men and women scientists.
2. No single instructional methodology will reach all children; role models will impact upon a small percentage of this group.
3. An absolute function is served by providing suitable Black role models for effective growth and interest in science.
4. By precept or example, role models are of paramount importance to children in the elementary grades.
5. Junior, senior and college students who have an interest in science can serve as effective role models for elementary school children.

TABLE 19, continued

6. Black scientists should be invited to the classrooms to discuss their work.

7. Elementary school children should be presented role models of Black scientists with noted accomplishments.

8. Visits by Black and White scientists should be a part of a science orientation process.

9. Parents are the best role models if the atmosphere is conducive and receptive.

10. The best science role models are those drawn from the local community.

CHAPTER V

DISCUSSION

In this chapter some attention was given to the demographic information on the scientists and to a lesser extent the demographic data on the teachers. Also an analysis and a suggested order of importance were presented for the categories of Teacher Influences, Parental Involvement, Community Influences and Role Models believed to be essential in consideration of science education for inner-city elementary school children. Furthermore, those significant ideas and opinions expressed by the scientists and agreed upon by the Black teachers were examined as a group and discussed under the appropriate category above.

Demographic Characteristics of Black Scientists

From the data in this study the ratio of males to females in this population of respondents was nine to one. The findings in this study seemed to concur with that of Jay (1971) who also had a similar population. This finding did, however, differ from those reported by the National Academy of Science (1978) in which case the ratio of males to females in the population of American scientists was reported to be three to one.

Although the scientists in this study were not asked to indicate their place of birth, they did indicate the region in America where they spent their early childhood. The majority of the scientists or 61 percent, spent their early childhood in the South. These findings are supported by Jay's study which also indicated the South as the major source for Black scientists. According to the National Academy of Science, the South as well as the Rocky Mountain States have increased their production of science doctorates in recent years.

The data on the elementary school experiences of the scientists in this study was of special interest because there was no comparable information in the literature reviewed. A majority of the participants' elementary education was in Southern rural areas. Only a few attended elementary schools in the city. Furthermore, it was found that they attended elementary schools that usually had an enrollment of 500 or more students. Moreover, the high school experiences for the majority of the scientists were in a Southern rural location and in schools with enrollments of at least 500 students.

Some aspects of the family and community life of the scientists were revealed in their responses to the questionnaire. They were generally children of

non-professional parents and their families tended to be small and more than half of them indicated that they were either the first or second child in the family. Also, more than half of them had access to home libraries.

Participation of the scientists during their youth in scientific activities in the community was minimal. Less than half of them indicated that they had participated in activities such as science fairs and museum science programs. However, 70 percent of them indicated that they had access to a public library in their community.

An examination of the post-secondary school experiences of respondents in this study revealed that approximately two-thirds of them received their undergraduate training in a predominantly Black school. Furthermore, the majority of them received their graduate training in predominantly White schools. The latter training was in agreement with an earlier study by Jay (1971) and is perhaps a reflection of the available science doctoral programs in predominantly Black universities. Only Howard University and Atlanta University offered doctorates in the natural sciences.

The geographical distribution of graduate schools from which the respondents received their doctorates was

examined. Twenty-four percent of the scientists in this report indicated having received their doctorates from a school in the Mid-Western region. When the group of seventy-four science doctorates in this study was compared with all the science doctorates reported by the NAS, there was close similarity in respect to regional output for doctorates.

The life sciences were found to be the major area of concentration for the Black scientists in this study. These findings were in agreement with that of Jay and also the NAS report. On the other hand, the findings in this study differed from those reported later above in that the population in this study contained proportionately more physical scientists and mathematicians.

The average undergraduate degree to doctorate time lapse for scientists in this sample was ten years. This finding agrees with that of Jay, and is approximately two years longer than that for science doctorates in the NAS survey.

Nearly 70 percent of the Black scientists in this study were employed in educational institutions as was true for those in Jay's report. Both these findings are higher than those reported in NAS for science employment in which case about half reported employment in

educational institutions between the years of 1960 and 1974. A possible reason for the large number of Blacks working in educational institutions may be related to two things, staffing needs in the institutions and the lack of opportunity for Black scientists in other sectors of the professional market.

The scholarly creditability of the scientists in this sample was good. As a group they had more than 1300 publications and more than half had served as science consultants to industry, universities and foundations. This is a credit to them when examined against the background of their employment, over half of whom work in predominantly Black institutions where opportunity for scholarly research in the sciences is limited.

This study revealed that these scientists had limited experience in working with youth in community activities.

Demographic Characteristics of Black Teachers

Of the 141 Teacher Opinionnaires that were distributed, forty-one in the public schools in Atlanta, Georgia and one hundred in Washington, D.C., eighty-one were returned form the Washington group and nineteen from the Atlanta group. Over half of the teachers were

female and nearly half of the respondents were in the age range of thirty to thirty-nine years.

Fifty of the responding teachers indicated a college major in elementary education, while the remainder had majors represented in fourteen other subject areas.

Over fifty percent of the teachers taught grades four through six and nearly three-fourths of the total number of respondents had five to nineteen years of teaching experience.

The public school teachers as a group who participated in this study had many years of experience in elementary school instruction. Furthermore, they had taught the entire range of elementary grades and subjects. The kinds of experiences and backgrounds found among these teachers suggested that they were creditable sources for judging opinions or the statements made by the scientists concerning science education among Black elementary school children.

Overview of the Categories

From the information provided by the scientists and using the number of occurrences of references made in their comments to each of the four categories, it could be said that they believed that the pair of categories

concerned with teachers and parents were of greater importance than role models and the community in influencing children to become science oriented. References were made by the scientists in nearly equal numbers to the categories in each pair.

When the statements in these categories were grouped following the elimination of duplicate opinions and ideas and presented to teachers to ascertain their agreement or disagreement with them, it was found that a new order of importance could be established. In descending order, they were: Teacher Influences, Community Influences, Parental Involvement and Role Models. From this kind of analysis the implication is that both Black scientists and teachers perhaps see the role of the teacher as paramount in directing and stimulating science activities among children. Based upon the results reported in Tables 16-19, the hypothesis which stated that: significant differences will exist between Black scientists and Black elementary school teachers concerning information that can serve as a basis for guidance in formulating new instructional approaches for science education in inner-city elementary schools was not supported. When the teacher responses to the statements were cross tabulated with the variables of the scientists, significant

agreement ($p \leq .05$) was found with at least one variable for 87 percent of the statements or opinions suggested by the scientists.

There is a convergence of opinions of the Black scientists on one hand, the majority of whom who had their early education in predominantly Black schools and teachers who work in inner-city schools. Each one attaches a high degree of significance to the importance of a teacher in stimulating the interest and possibly modifying the attitudes of Black children toward science. It's interesting, at least in this analysis, that the concept of role model is of limited importance.

Furthermore, it appears that the parents and community are nearly equal in importance for stimulating and interesting Black children in science.

Teacher Influences

Within the category of Teacher Influences the items that occurred the greatest number of times were those that related to providing classroom exposure in science for the children. Moreover, it seemed that the teacher should provide the kind of information that will give the child some idea of the relation between science and himself as an individual as well as the world in

which he lives. Additionally, there is strong agreement that teachers should identify and encourage those students who are interested in science. Although, there was some agreement on items relating to teaching methodology, preparation, and motivation these areas ranked far below those indicated above.

Community Influences

Within the category of Community Influences it seems that the teachers agree with the scientists in that the community may offer a number of resources that could supplement and reinforce the child's school experience. Organizations such as science clubs sponsored by community agencies were felt to be most useful in enhancing or reinforcing the children's interest and attitudes toward science. Additionally, it was believed that coordinated efforts between the community and the school should be made to provide the children with an opportunity to observe science exhibits, science facilities and role models. In essence, it was believed that steps should be taken to coordinate efforts among the community, school and scientists to improve the interest of Black children toward science.

Parental Involvement

The major issue in Parental Involvement appeared to be that parents should take an active role in creating a home environment that would expose the child to science. Parents may do this by encouraging children to watch television programs related to science; by providing them with scientific toys; and by cooperating with teachers in encouraging good study habits for their children. Moreover, it appears that parents do not have to be scientists nor professionals in order to provide the incentive and encouragement needed for children to appreciate and have a positive attitude toward science. Perhaps the important thing that was believed to be needed was the willingness of parents to encourage their children's curiosity, creativity and insist on discipline in the performance of their educational tasks.

Role Models

It was generally agreed among the participants that the use of scientists as role models will have some effect on the child's attitude toward science. It was clear, however, that there was strong agreement between the Black scientists and Black teachers regarding the racial characteristics of role models used for inner-city elementary school children who are largely Black.

They have indicated that the role models used should be Black females and Black males drawn preferably from the local community. The findings, however, do not exclude the utilization of White scientists as role models. Furthermore, it was indicated that college students and high school students who are science oriented can serve as effective role models.

In summary, Richardson (1976) put in perspective the status and future of American Black people in science when he indicated that Black Americans lack a history of achievement in the natural sciences and the problem of motivation of Black children at an early age to pursue science will probably remain for generations to come. The writer believes that the findings in this research are germane to the problem expressed above. Furthermore, the comments by Richardson and the analysis of the present study are of and about the Black experiences in America regarding interest and motivation in the natural sciences.

The focus in this study was on inner-city elementary school children who are usually Black and frequently referred to as disadvantaged. Deutsch (1963) has presented a dismal picture of hopelessness about these children; their families; and general environment. The Mayor's Advisory Panel (1963) on the schools in New York

City pointed out clearly that a child's community environment is a powerful influence on his attitude toward learning; the school; and the teachers. Mann (1967) placed this matter in sharp focus with suggested guidelines for successful educational programs in the inner city.

Further observation on the educational needs of the inner-city or disadvantaged child were made by Gordon and Wilkerson (1966). They stated that these children are "disadvantaged to the degree that their culture has failed to provide them with the experiences that are normal to the kinds of children the schools are teaching" (p. 36). Henderson (1967) reported that the schools merely attempt to accelerate the child into existing educational standards by using existing educational practices. Additionally, he stated, "school programs should take into account who the students are, the nature of their world and their particular needs" (p. 157). There are, however, individuals who have suggested lines of approach that may offer hope for inner-city children. The Black scientists and the inner-city elementary school teachers participating in this study are among them.

There are two points that have grown out of this study. (1) The scientists did not mention in any of their comments or opinions concerning improving science

attitudes among Black children the need for additional funding for school programs. (2) No mention was made of the need for purchase or the utilization of prefabricated science kits or programs which could be used in the instruction of inner-city elementary school children. It would appear then that the essence of their opinions and those agreed upon by the teachers were concerned with a change in the approach to the instruction of these children. Parents, teachers and communities should be organized into a program designed specifically to influence Black children's thinking and interest toward science. An essential part of this effort should be the utilization of effective and appropriate role models.

In other words, the teachers and scientists believed that the resources are already available to the school systems which could be better utilized for more effective science instruction in inner-city elementary schools. Perhaps what is needed is an increased level of awareness among the policymakers and educators regarding the need to change the approach of science instruction among Black elementary school children and an awareness of some of the remedies available without additional cost.

> Elementary science can be an excellent medium for motivating and otherwise working with the special problems of disadvantaged children...the major emphasis should be placed on the quality of learning experience as opposed to the quantity of material covered (Webster, 1970, p. 53).

CHAPTER VI

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

There was a belief among inner-city elementary school teachers that Black children in these schools had a negative attitude toward science. Statements of concern were voiced among teachers in school staff meetings and in informal conversations. Aside from the concerns about the general lack of interest and seemingly poor attitudes toward science among these children, there was the whole question of their future lives in the technological age. Even if these children failed to have careers in science, they would indeed have to live as adults in a science oriented society. As adults they should have an appreciation and a reasonable degree of understanding about science and technology.

An investigation about the status of science among Black Americans indicated that only a few Black people in the history of America had achieved a doctorate in a natural science. It occurred that perhaps these individuals could be a possible resource for information regarding ideas and strategies that could be used to improve the science attitudes among Black

elementary school children. Furthermore, since inner-city teachers were actually involved in the education of these children, they too should be able to have some input into the possible solution of this problem. A study was subsequently designed to illicit information from the Black scientists and Black inner-city teachers about what could be done to improve the science attitudes and interests among Black children. The purpose of this study was to obtain from Black scientists for their thoughts about what should be done in order to improve the status of science among inner-city school children; and to determine the level of agreement that inner-city teachers would have with the ideas or opinions from the scientists.

The working hypothesis for this study was: significant differences will exist between Black scientists and Black elementary school teachers concerning information that can serve as a basis for guidance in formulating new instructional approaches for science education in inner-city elementary schools.

A literature search revealed several areas that may have implications for changing the attitudes of Black children toward science. (a) Parents in their interactions with their children at home and with the schools were found to be influential in the child's school

activities. (b) Teachers who exhibited warmth and understanding were important for the motivation of elementary school children. (c) Community institutions working in concert with parents and teachers were an excellent resource for providing an impetus for children's learning. (d) A child's attitude towards science is shaped and influenced in many instances by the attitude of the teacher toward this subject. Furthermore, the teacher brought to the classroom an attitude toward science that was nurtured by his/her educational experiences. (e) It was found that children would imitate adult models whether they were alive or presented through media such as film and television.

One hundred twenty-five Black scientists were mailed questionnaires. They were asked to provide some demographic information and to develop a statement regarding what they felt could be done to improve the status of science attitudes among inner-city school children. Fifty-nine percent of the questionnaires were completed and returned. The demographic data from the scientists was recorded; and their statements analyzed and classified into the following categories: Teacher Influences; Parental Involvement; Role Models; and Community Influences. A teacher opinionnaire was then constructed.

One hundred forty-one Teacher Opinionnaires were distributed among teachers in Atlanta and Washington, D.C. inner-city elementary schools. The teachers were asked to indicate agreement or disagreement with each statement and to provide a limited amount of demographic data.

All information obtained from the Black scientists along with the teacher data were coded and placed on computer cards. The data were processed using the Social Science Statistical Package in the computer laboratory at Howard University. Statements showing Chi Square level of agreement ($p \leq .05$) between the scientists' variables and the teacher responses were accepted as significant.

The wide ranges of backgrounds and experiences found generally among the Black scientists and the teachers in their aprticular occupations gave creditability to the opinions and statements made and agreed upon by the two groups. The teachers agreed with the majority (87%) of the statements taken from the scientists' comments, therefore rejecting the hypothesis of this study.

The implication from this study was that the Black scientists and teachers agreed that certain specific activities associated with teacher influences; parent involvement; community influences; and role models may

be useful in altering the attitudes of Black children toward science. A further implication was that the most important influence was that of the teacher.

In addition, it should be noted that no mention was made by the participants in this study of the need to purchase or the need for utilization of prefabricated science kits or programs to be used in changing the attitudes of inner-city Black children toward the science area.

Conclusions

Evidence provided by the study data led to the following conclusions.

The hypothesis which stated that there would be significant differences between Black scientists and Black elementary school teachers concerning information that can serve as a basis for guidance in formulating new instructional approaches for science education in inner-city elementary schools was not confirmed.

The majority of the Black scientists surveyed indicated in their comments that the teacher influences were most important for affecting change in the attitude of Black children toward science.

Both scientists and teachers agreed that the order of importance for the categories used in this study for affecting change in the attitude of Black children toward science should be those activities associated with (1) teacher influences; (2) community involvement; (3) parent influences and; (4) role models.

Recommendations

1. It is recommended that the findings in this study be used as a basis for initiating an evaluation of science instruction in the inner-city elementary schools with the view of formulating policy for the improvement of the attitudes of inner-city Black children toward science.

2. It is recommended that a similar study be conducted with a larger Black teacher population from additional inner-cities of metropolitan areas.

3. It is recommended that a similar study be conducted using a non-Black teacher population from inner-city schools of metropolitan areas.

APPENDIX A

Survey Materials

Cover Letter

Questionnaire

Opinionnaire

Tubman Elementary School
Washington, D. C.
March 1, 1977

Dear Sir:

I have been teaching elementary school for sixteen years. My experiences as a teacher have been in Atlanta, Georgia and Washington, D.C. I am now in the process of fulfilling the requirements for an advanced degree.

Presently, I am undertaking a research project in the general area of attitudes toward the study of science. My specific area of interest in this regard is the Black Elementary School Children and what can be done in instructional programs in inner-city schools that may modify positively their attitudes toward the study of science.

The attached questionnaire is part of a study that will be conducted in the inner-city of Washington, D. C. It is concerned with the attitudes of Black Elementary School Children toward the study of science and science as a career choice.

Although you may or may not have taught elementary school students, I am particularly desirous of obtaining your responses because of your outstanding experience as a Black scientist. A part of this study will consist of an instructional unit designed to incorporate your opinions or ideas on how more positive attitudes toward science may be developed among Black children.

It will be appreciated if you would complete this questionnaire prior to March 21, 1977 and return it in the self-addressed envelope. Much of the kind of information sought may appear in Who's Who in Science. I am seeking, however, to be more inclusive and descriptive of certain areas in your background.

Please note that phases of this project cannot be carried out until I receive your completed questionnaire.

Thank you for your cooperation.

Sincerely,

Roedean S. Anderson
Teacher
Tubman Elementary School

QUESTIONNAIRE

Directions:

Please fill in this form or check the answers most applicable to you. Although each item is important to this study, kindly feel free not to answer any item in Part I that you may deem personal.

PART I

Name_____Address_____

City_____State_____

Zip Code_____Telephone Number_____Sex_____

Present Marital Status:Single_Married_Divorced_Separated_

Widowed__Age Range:20-29__30-39__40-49__50-59__60-69_____

Over 69__No. of Children: Boys__Girls__Spouse's Occupation

_____

_____

Educational Data:

Graduate School(s)	Location	Field of Concentration	Degree Received	Date

Questionnaire

Page 2

Undergraduate School	Location	Field of Concentration	Degree Received	Date

High School	Enroll-ment	Location	Program Emphasis	Date

Elementary School	Location	Enrollment

Have you ever taught science courses to Black elementary School children? ___Yes___No

Where are you presently employed?

Name of Firm_____

Location_____

Questionnaire

Page 3

What is your present occupation?

_____

Specify your major duties_____

_____

Are you a member of any advisory boards, panels or do you hold any directorships? If so, please list.

_____

_____

_____

Have you served as a consultant?

Yes____ No____

If your answer is yes, please specify_____

_____

_____

Have you published any of the following?

Journal articles_____Number_____

Books _____Number_____

Monographs _____Number_____

Other (specify) _____

Questionnaire

Page 4

Have you been involved in community programs directly related to the development of youth? Please list.

_____

_____

_____

List the following that you have received. Include dates.

Honors_____

_____

Prizes_____

_____

Awards_____

_____

Where did you spend your childhood years?

Rural area_____City_____

Town_____Metropolitan Area_____

Check your geographical region.

Northern____Southern____Eastern____Western_____

Questionnaire

Page 5

Number of siblings in your family?_____

Circle your position in family. 1 2 3 4 5 6 7 8 9 10

Are other siblings in occupation fields similar to yours?

Yes____No_____Specify_____

_____

Did you have access to the following as a child?

Home Library_____ Public Library_____

Did you participate in any science programs in your youth?

Yes_____No_____Specify_____

Occupation of parents.

Father_____

Mother_____

Guardian_____

*Please answer this part. You may use the back of the page.

Questionnaire

Page 6

PART II

A. Please give your thoughts about your own training and the influences that led you to a career in science.

B. Please develop a statement of your ideas as to how one may improve the attitudes of elementary school students toward science and science careers. In your discussion include your thoughts on how teachers, role models, parental involvement and the community may be used effectively in this activity.

Any other thoughts that you may have on this matter will be appreciated.

TEACHER OPINIONNAIRE

An instrument to assess the amount of agreement that Black elementary school teachers have with ideas and activities suggested by Black scientists for the improvement of attitudes of Black youth towards science.

Directions:

Please volunteer your assistance. Below is a list of statements of actions or ideas from Black scientists which could improve the attitudes of Black inner-city students toward science. As an experienced teacher, what is your opinion about each statement? Please indicate as to whether you agree or disagree with each statement. If you agree with the statement write A on the line before the statement. If you disagree with the statement write D on the line before the statement. Thank you for your honest opinions.

Position_____Number of Teaching Years_____

Grade or Subject_____Age Range: 20-29___30-39____

40-49____50-59____60-69____Sex____College Major_____

Agree - A Disagree - D

___1. To foster a positive outlook toward Black scientists, teachers could explain the contributions made by them to elementary school students.

___2. Use living specimen in experiments.

___3. Attitudes may not be dictatorially established.

___4. The technique that has a higher than normal impact as a motivational tool for positive attitudinal changes for elementary school children is the "problem centered approach" in teaching science.

___5. Positive attitudes toward science are bound to occur when teachers are held accountable for students receiving maximum science exposure in the elementary grades.

___6. Science specialists should travel from school to school demonstrating science units to students in the elementary schools.

___7. Teachers should make elementary school students aware of the rewards (personal and financial) for mastering science.

___8. Effective teachers should include facts of Biology to students in the elementary grades with the primary principles of ecology emphasized.

___9. Science is not taught in the school system, but students are taught a series of basic tools necessary for quantitative thoughts.

__10. To encourage students in the elementary school to develop a positive attitude toward science, teachers should expose them to the interesting and intriguing aspects of science.

__11. Elementary school children should be exposed to both Black men and women scientists.

__12. No single instructional methodology will reach all children (elementary), role models will impact upon a small percentage of this group.

__13. The single most important way in which to affect attitudes of Black elementary school students is by personal exposure to Black scientists in their laboratories.

__14. The best science role models are those drawn from the local community.

__15. An absolute function is served by providing suitable Black role models for effective growth and interest in science.

__16. The local communities should provide films, demonstrations, science fairs and visits to science museums for elementary school students.

__17. Science and math clubs should be sponsored by community agencies.

___18. The institutions of higher education should sponsor science programs for Black elementary school children.

___19. General community programs should be designed to bring in parents and local industry into dialogue to assist in stimulating students' interest in science.

___20. Although teachers can provide some exposure to science, motivation has to come from within the student.

___21. Elementary school children should discover (through current events as well as basic information) that their whole life is surrounded by science, its devices and problems.

___22. Elementary school students who are able to interact with science and not just learn it are more apt to have positive attitudes toward the subject.

___23. The attitude of teachers toward science is important.

___24. The teaching of science must be made interesting by relating sciences to environment of elementary school children.

___25. Only one parent is necessary to encourage a positive attitude toward science.

___26. A father's occupation may influence a child to have a positive attitude toward science.

___27. Parents should encourage their children's curiosity about the physical and/or biological world.

___28. Educated parents are more likely to influence children to participate in science activities.

___29. Families can motivate elementary school children to develop meaningful objectives with education as a decisive tool.

___30. Mothers sometimes think science is not a proper subject area for women.

___31 Museums should sponsor science fairs involving the use of Black role models and exhibits of projects jointly developed with these Black scientists.

___32. By precept or example, role models are of paramount importance to children in the elementary grades.

___33. Role models are unnecessary for the development of positive attitudes toward science.

___34. Junior and Senior high school students as well as college students who have an interest in science can serve as effective role models for elementary school children.

___35. Black scientists should be invited to the classrooms to discuss their work.

___36. Childhood exposure to nature will lead to an interest in science.

___37. There should be an organized effort by the community to provide role models for the children.

___38. The teacher should coordinate his or her efforts with the parents and the community to select and dramatize Black scientists.

___39. Community efforts will have a small effect on the attitudes in elementary school.

___40. The community can provide some degree of exposure to science, although the motivation for study of science has to come from within.

___41. High school may be too late to develop the right kind of science attitude for success, therefore, exposures to science must come early in the training of children in order that an aptitude for the discipline is developed.

___42. A negative attitude toward science may develop when students are exposed to science teachers whose primary training or interest is not science.

___43. Elementary school children with natural abilities in science should be identified and encouraged early.

___44. The ability to communicate verbally and in written form is of paramount importance in science for students in elementary school.

___45. Personal exposure of elementary school students to scientific equipment, ideas and professionals is essential in the task of implanting the desire for a scientific career.

___46. The only way to influence the attitudes of elementary school children is by providing Black scientists as role models.

___47. Visits by Black and White scientists should be a part of a science orientation process.

___48. Elementary school children should be presented role models of Black scientists with noted accomplishments.

___49. Early orientation to science can be related to one's ethnic heritage.

___50. A child whose parents are scientists are more likely to have a positive attitude toward science.

___51. Poor and undereducated parents can be influential in the education of their children in science.

___52. Parents who encourage their children to play with scientific toys are also encouraging positive science attitudes among them.

___53. Students with a special aptitude for science should be encouraged by parents to pursue this vocation.

___54. General community programs in science should be designed to bring in parents.

___55. Parental involvement could be useful in some middle class communities, but widespread

parental involvement can be counted upon in minority and/or other disadvantaged areas.

___56. Teaching of science must be made interesting by relating science to students' environment.

___57. It is essential that young children be introduced to scientific methods through examples from their lives and convinced that appropriate analytical skills are obtainable and necessary for the study of science.

___58. High school is the best time to stimulate an interest in science, lower grades could be too early.

___59. Teachers are perhaps the most important people that young people meet in influencing what becomes their favorite subject and often career field.

___60. Elementary school children should see science as interesting and not as being difficult or weird.

___61. The community should provide opportunities for students to see what's going on in the scientific world.

___62. Scouting programs are helpful in creating positive attitudes toward science.

___63. Parents can provide many experiences around the home for sixth graders that would generate the development of a strong background for technology and a positive attitude for the sciences.

___64. A disciplined home environment will contribute to the success of students in science.

___65. A child's interest in science and education is created and initiated in the home.

___66. Parental involvement will have a small effect on the science attitudes of elementary school children.

___67. The role of the teacher is to spark independent inquiry and to start the student asking his own questions and generating his own answers.

___68. The community should encourage its scientific organizations and institutions to hold open house activities for children in the elementary schools.

___69. Parents should assist children in their science work until the child becomes more aggressive in their attitude toward science.

___70. Parents who support the student in his pursuit of science are those who do not placate the child with, "I don't understand it either."

___71. Math and science are related, therefore good instruction in math is helpful in fostering a positive attitude toward science.

___72. Science and science-related TV programs could serve as a stimulus to sixth graders if TV viewing is monitored by parents.

___73. A positive attitude toward science could be generated among elementary school students through tutorial demonstrations and visits to scientific job areas.

___74. Parents should work with the teachers in developing good orderly study habits and an appreciation for science and technology as it is applied to everyday living.

___75. Visitations by children to science exhibits that they can handle may be helpful.

___76. Parents are the best role models if the atmosphere is conducive and receptive.

___77. Perhaps elementary school teachers could initiate a link between racial pride and a personal challenge in order to create a positive attitude toward science.

___78. The most significant influence can be attributed to the interest, concern and comfortability evidence by teachers who teach science.

___79. These characteristics are important in contributing to the development of positive attitudes toward science in Black elementary school children.

_____a) Curiosity

_____b) Independence

_____c) Determination

_____d) Critical thinking

_____e) Self-motivation

_____f) Self-esteem

_____g) Natural Interest

NAME _____ SCHOOL _____

APPENDIX B

Tables

TABLE 20

A Listing of Black Scientists'

Demographic Varibles

1. Elementary School Enrollment	14. Graduate School Degree Field
2. Elementary School Location	15. Graduate School Location
3. Elementary School Race	16. Graduate School Race
4. High School City Location	17. Year of Highest Degree
5. High School Enrollment	18. Sex
6. High School Graduation Date	19. Marital Status
7. High School Program Emphasis	20. Occupation (Spouse)
8. High School Race	21. Publications
9. High School Regional Location	22. Children (Boys)
10. Undergraduate Degree (Type)	23. Children (Girls)
11. Undergraduate Degree Field	24. Type of Employment
12. Undergraduate School Location	25. Location of Employment
13. Undergraduate School Race	26. Taught Science to Youth

TABLE 21

A List of the Variables and the Level of Significance in Each Specific Category When Cross-Tabulated With the Scientists' Statements and Teachers' Responses

VARIABLE	CHI SQUARE (P)
Teacher Influences	
Statement (6) from Opinionnaire	
Elementary School Race	.0061
High School City Location	.0130
High School Regional Location	.0085
Undergraduate College Race	.0131
Undergraduate College Location	.0032
Taught Science to Youth	.0205
Occupation	.0096
Publications	.0038
Type of Employment	.0004
Employment Location	.0124
Statement (22) from Opinionnaire	
Elementary School Location	.0290
Elementary School Race	.0188
High School Enrollment	.0046

TABLE 21, continued

VARIABLE	CHI SQUARE (P)
High School Graduation Date	.0032
Graduate School Race	.0201
Year of Highest Degree	.0049
Marital Status	.0070
Statement (38) from Opinionnaire	
Elementary School Enrollment	.0494
Elementary School Race	.0408
High School Enrollment	.0025
High School Graduation Date	.0116
Marital Status	.0408
Statement (43) from Opinionnaire	
Sex	.0494
Elementary School Race	.0051
High School Race	.0108
Undergraduate College Race	.0041
Marital Status	.0002
Statement (1) from Opinionnaire	
Elementary School Race	.0352
High School Race	.0459
Undergraduate School Location	.0396

TABLE 21, continued

VARIABLE	CHI SQUARE (P)
Occupation	.0059
Q A2	.0016
Q B2	.0013
Statement (21) from Opinionnaire	
High School Race	.0450
High School Graduation Date	.0417
Undergraduate School Race	.0022
Marital Status	.0226
Sex of Children (Male)	.0492
Statement (57) from Opinionnaire	
Sex	.0228
Elementary School Location	.0355
High School City Location	.0007
High School Race	.0062
Undergraduate School Race	.0010
Undergraduate School Location	.0110
Undergraduate School Degree	.0059
Graduate School Location	.0410
Graduate School Race	.0201
Marital Status	.0125

TABLE 21, continued

VARIABLE	CHI SQUARE (P)
Community Influences	
Statement (68) from Opinionnaire	
Undergraduate Degree Field	.0012
Undergraduate School Degree	.0012
Undergraduate School Race	.0121
Graduate School Location	.0035
Marital Status	.0000
Statement (37) from Opinionnaire	
Undergraduate Degree Field	.0340
Undergraduate School Degree	.0340
Highest Degree Earned	.0184
Marital Status	.0014
Sex of Children (Male)	.0292
Statement (17) from Opinionnaire	
Elementary School Location	.0185
Elementary School Race	.0427
High School Location	.0509
Graduate School Race	.0315
Marital Status	.0077

TABLE 21, continued

VARIABLE	CHI SQUARE (P)
Statement (36) from Opinionnaire	
Elementary School Race	.0227
High School Location	.0502
Undergraduate Degree Field	.0449
Graduate School Race	.0340
Marital Status	.0002
Statement (40) from Opinionnaire	
Elementary School Location	.0436
Elementary School Race	.0437
High School Location	.0434
Undergraduate School Location	.0392
Marital Status	.0105
Parent Involvement	
Statement (63) from Opinionnaire	
High School Graduation Date	.0055
Undergraduate School Race	.0053
Undergraduate School Degree Field	.0000
Undergraduate Degree (Type)	.0009
Year of Highest Degree	.0087
Marital Status	.0304

TABLE 21, continued

VARIABLE	CHI SQUARE (P)
Role Models	
Statement (11) from Opinionnaire	
Elementary School Location	.0422
High School Graduation Date	.0000
High School Enrollment	.0497
High School Location	.0282
High School Race	.0170
Graduate School Race	.0409
Year of Highest Degree	.0034
Marital Status	.0005

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